Mission Directorate: Aeronautics Research

Overview

Over the last century, aviation has evolved to become an integral part of the economy and an essential component of everyday life. As the Nation and the world become more dependent on moving people and goods faster and more efficiently via air, important constraints to further growth have emerged. During peak travel times, the air traffic and airport systems in the United States and other nations are stretched to capacity. In 2007, airline delays in the United States cost industry and passengers $32.9 billion.* Environmental concerns such as aircraft noise and emissions limit increased operations and the expansion of airports and runways. These constraints to growth threaten the commercial prospects of the aerospace industry and contribute to continued or worsened airline travel delays.

In response to these challenges, the Nation is pursuing the realization of Next Generation Air Transportation System (NextGen). NextGen will accommodate more aircraft operating within the same airspace, including aircraft with widely varying performance capabilities (e.g., different speeds, altitudes, and maneuverability). The revolutionary changes to the airspace system and the aircraft that fly within it envisioned for NextGen will lead to a safer, more environmentally friendly, and more efficient national air transportation system, characterized by reduced community noise and improved local air quality, water quality, and energy efficiency. This will occur even with the projected increase in air traffic.

To achieve NextGen, the aviation sector needs to capitalize on the convergence of a broad range of multidisciplinary advances in technology. This will include pursuing technologies that are in their infancy today, developing the knowledge necessary to design radically new aviation systems, and enabling efficient, high-confidence design and development of revolutionary vehicles. These improvements must take place without compromise to the current safety record of the aviation industry. Increasing system capacity while maintaining or even improving aviation safety will require the ability to identify and respond to precursors to accidents, instead of today's practice of creating or changing flight rules in response to incidents and accidents.

As the Federal Government's largest civil aeronautics research organization, NASA, through its Aeronautics Research Mission Directorate (ARMD), plays a key role in the discovery and development of the innovative solutions and advanced technologies required for NextGen. NASA performs cutting-edge research on innovative concepts, tools, and technologies that will enable revolutionary advances in future aircraft, as well as to the airspace in which they will fly. This investment portfolio is a balanced mix of foundational and systems-level research, and related test infrastructure addressing aviation safety, energy efficiency, environmental compatibility, airspace capacity, and operational efficiency. NASA's aeronautics programs uniquely address specific aeronautical research needs while taking an integrated approach with respect to critical long-term challenges. It also addresses the long-term research needs in access-to-space technologies required for future space missions.

NASA expands the boundaries of aeronautical knowledge for the benefit of the Nation through partnerships with academia, industry, and other government agencies, helping to foster a collaborative research environment in which ideas and knowledge are exchanged across all communities. These collaborations help ensure the future competitiveness of the Nation's aviation industry.

* "Total Delay Impact Study," October 2010, National Center of Excellence for Airline Operations Research.

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	Auth Act FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**497.0**	**501.0**	**579.6**	**569.4**	**569.4**	**569.4**	**569.4**	**569.4**
Aeronautics	497.0	-	-	569.4	569.4	569.4	569.4	569.4

Note: The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

The "Auth. Act FY 2011" column represents FY 2011 authorized funding from the NASA Authorization Act of 2010 (P.L. 111-267).

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

Plans for FY 2012

Aeronautics Research

Aeronautics

New Initiatives:

None

Major Changes:

The following changes have been made to the Aeronautics budget.

- Research into high-altitude ice crystal effects on aircraft has been increased. The objective of this research is to increase the probability that NASA's capability will support community response to rule-making and thus increase aviation safety in a timely manner.

- Additional research will be conducted into the effects of lightning strikes on composite materials. This research will accelerate development of standardized test procedures to support development of sensor concepts, advanced models, and protection methods.

- NASA also will increase research efforts in composite structures and materials in order to develop new materials and analysis capabilities so that they can be effectively utilized in new designs.

- Alternative fuels research will be increased. This will help to advance the use of alternative fuels (including biofuels) in aircraft, which is a key factor in substantially reducing the impact of aviation on the environment--specifically reducing the gaseous and particulate emissions of aircraft.

- NASA also will increase research into efficient and safe airport surface operations. Technologies will be integrated from the current NASA portfolio to further advance greater utilization of ADS-B application technologies providing optimization of airport surface movements with precise scheduling to reduce surface and en-route traffic delays and enhance safety.

- NASA will also increase flight research that focuses on low-cost, simple, short-term flight demonstrations aimed at enhancing aviation safety and airspace efficiency.

- Hypersonics research is reduced and focused on goals outlined in the National Aeronautics R&D Plan, where NASA possesses unique competencies relied upon by other agencies. This research will be foundational in nature and focused on knowledge development and tool creation.

Major Highlights for FY 2012

In FY 2012, NASA will continue to conduct long-term, cutting-edge research for the benefit of the broad aeronautics community. Each of the six programs within Aeronautics plays a significant role in addressing the challenge of meeting the growing capacity needs of NextGen, contributing to research and development (R&D) challenges in aviation safety, promising new flight regimes and aviation environmental impacts.

- The Aviation Safety Program (AvSP) provides knowledge, concepts, and methods to manage increasing complexity in the design and operation of vehicles and the air transportation system. This includes advanced approaches to enable improved and cost effective verification and validation of flight critical systems. AvSP provides knowledge, concepts, and methods to avoid, detect, mitigate, and recover from hazardous flight conditions and to maintain vehicle airworthiness and health. The program will investigate sources of risk and provide technology needed to help ensure safe flight in and around atmospheric hazards.

- The Airspace Systems Program (ASP) develops and explores fundamental concepts, algorithms, and technologies to increase throughput of the National Airspace System (NAS) and achieve high resource efficiency. The program transitions key technologies from the laboratory to the field by integrating surface, terminal, transitional airspace, and en route capabilities to enable operational enhancements envisioned by NextGen.

- The Fundamental Aeronautics Program (FAP) conducts fundamental research to improve aircraft performance and minimize environmental impacts, explores advanced capabilities and configurations for low boom supersonic aircraft, conducts fundamental hypersonic research to enable new capabilities, and radically improves the civil effectiveness of rotary wing vehicles by increasing speed, range, and payload while decreasing noise and emissions.

- The Integrated Systems Research Program (ISRP) conducts research on promising concepts and technologies at an integrated system level. The program explores, assesses, and demonstrates the benefits of these potential technologies in a relevant environment.

- The Aeronautics Test Program (ATP) ensures the strategic availability, accessibility, and capability of a critical suite of aeronautics ground test facilities and flight operations assets to meet Agency and national aeronautics testing needs.

- The Aeronautics Strategy and Management Program (ASMP) has been established by transferring ongoing activities from ISRP and FAP. The program will explore novel concepts and new processes in aeronautics, funds institutional expenses for the Mission Directorate, fund the ARMD portion of the Joint Planning and Development Office (JPDO) costs, and provide education and outreach opportunities for a wide variety of interested participants of all ages.

Theme Overview

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**497.0**	**-**	**569.4**	**569.4**	**569.4**	**569.4**	**569.4**
Aviation Safety	74.0	-	48.5	47.8	46.7	45.4	44.0
Airspace Systems	79.0	-	70.3	69.4	67.7	65.8	63.8
Fundamental Aeronautics	199.0	-	97.2	95.9	93.6	90.9	88.2
Aeronautics Test	65.6	-	50.7	50.0	48.8	47.4	46.0
Integrated Systems Research	56.9	-	81.7	80.6	78.6	76.4	74.1
Aeronautics Strategy and Management	22.6	-	24.3	24.0	23.4	22.8	22.1
ARMD Civil Service Labor and Expenses	0.0	-	196.7	201.7	210.6	220.7	231.3

Note:

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In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the program amounts shown above. The allocation to each program is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

Relevance

Relevance to national priorities, relevant fields, and customer needs:

NASA's aeronautics research activities are well aligned with the National Aeronautics Research and Development Policy and Plan that identify national-level principles, goals, and objectives for the Nation's aeronautics R&D enterprise. This guidance was developed under the leadership of the White House Office of Science and Technology Policy, in collaboration with other Federal agencies, and in consultation with the broader aeronautics community. NASA research activities also are specifically identified as critical elements of the interagency work plan developed through JPDO to identify and assess critical research needed for NextGen. Independent reviews involving external subject matter experts and internal systems analyses shape the nature and direction of NASA's research programs to ensure the Agency remains focused on priority challenges.

Interagency coordination committees provide NASA with a collaborative framework during research program execution. Partnerships with Federal agencies such as the Federal Aviation Administration (FAA) and the Department of Defense (DOD) for activities (e.g., joint research, simulations, field trials, infrastructure management, and technology transfer) support effective alignment of research with community needs and facilitate the effective transition of research results. NASA also partners with large and small manufacturers through Space Act Agreements to conduct fundamental research, test novel new concepts and technologies, and transition advancements from the laboratory into the field.

Relevance to the NASA Mission and Strategic Goals:

Aeronautics research supports the Agency's Strategic Goal 4, to "Advance aeronautics research for societal benefit." Aeronautics work also supports NASA Strategic Goal 5, to "Enable program and institutional capabilities to conduct NASA's aeronautics and space activities," specifically objective 5.3, to "Ensure the availability to the Nation of NASA-owned strategically important test capabilities."

Relevance to education and public benefits:

NASA's aeronautics research programs provide direct and indirect benefit to the public. Fundamental research in traditional aeronautical disciplines and relevant emerging fields enable revolutionary changes which lead to a safer, more environmentally friendly, and more efficient national air transportation system to benefit the flying public. NASA research results are disseminated to the widest practicable extent to facilitate transfer of knowledge to the broader aviation community and support the evolution of the U.S. industrial base.

NASA's Aeronautics programs engage students and teachers at all levels of learning through research grants, scholarship programs, internships, design competitions, exhibits, and hands-on activities. Formal and informal educational activities are aimed at ensuring a sufficient quality and quantity of aerospace workforce to fulfill future needs of the Agency and the aerospace community. ARMD targets activities to key constituencies in different age brackets, and those activities are well integrated into the overall NASA education portfolio, including providing subject matter experts and aeronautics-related materials that are complementary to the Agency portfolio and activities. Education programs are designed for elementary through high school students and are linked to national and state standards of learning.

These programs provide an introduction to aeronautics disciplines while supporting the broader science, technology, engineering and mathematics (STEM) education goals of the Administration. Many of these programs provide curriculum and tools that can be brought into the classroom by teachers, acting as a multiplier effect for each dollar invested by NASA. NASA Research Announcements (NRAs) foster collaborative research partnerships among NASA, academia and the private sector while serving as a pipeline for innovative solutions to national challenges.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics

Performance

Performance Commitments:

Measure #	Description	Contributing Program (s)
Strategic Goal 4	**Advance aeronautics research for societal benefit.**	
Outcome 4.1	**Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation.**	
Objective 4.1.1	**Develop advanced technologies to improve the overall safety of the future air transportation system.**	
Performance Goal 4.1.1.1	***Transfer knowledge to the aviation community to better manage safety in aviation.***	
APG 4.1.1.1: AR-12-1	Develop first generation engine icing performance degradation parametric simulation capability.	Aviation Safety
APG 4.1.1.1: AR-12-2	Provide static code analysis techniques for certification.	Aviation Safety
APG 4.1.1.1: AR-12-3	Develop concept of operations for an integrated vehicle health assurance system.	Aviation Safety
APG 4.1.1.1: AR-12-4	Demonstrate algorithm to predict at least three anomalies in massive datasets.	Aviation Safety
Objective 4.1.2	**Develop innovative solutions and technologies to meet future capacity and mobility requirements of the Next Generation Air Transportation System (NextGen).**	
Performance Goal 4.1.2.1	***HPPG: Increase efficiency and throughput of aircraft operations during arrival phase of flight.***	
APG 4.1.2.1: AR-12-5	Develop Initial Weather Translation Models.	Airspace Systems
APG 4.1.2.1: AR-12-6	Demonstrate safe Interval Management Procedures to a Single Airport with dependent parallel runways.	Airspace Systems
APG 4.1.2.1: AR-12-7	NASA will provide the results of the human-in-the-loop (HITL) simulations and the field trial to the Federal Aviation Administration (FAA) as they are completed, with the final report being provided in September 2012. (HPPG milestone)	Airspace Systems
Objective 4.1.3	**Develop tools, technologies, and knowledge that enable significantly improved performance and new capabilities for future air vehicles.**	
Performance Goal 4.1.3.1	***Deliver tools, technologies, and knowledge that can be used to more efficiently and effectively design future air vehicles and their components that overcome national performance and capability challenges.***	
APG 4.1.3.1: AR-12-10	Validate the effectiveness of Micro-array Flow Control devices for improving performance and flow quality in low-boom supersonic propulsion inlets.	Fundamental Aeronautics
APG 4.1.3.1: AR-12-11	Demonstrate First Generation Integrated Multidisciplinary Simulation Tool for Analysis and Design of Reusable Air-Breathing Launch Vehicles.	Fundamental Aeronautics
APG 4.1.3.1: AR-12-8	Characterize gaseous and particulate emissions of hydro treated renewable jet fuel as a potential carbon dioxide (CO2) neutral aviation fuel.	Fundamental Aeronautics
APG 4.1.3.1: AR-12-9	Demonstrate drag reduction benefits of active flow control for a representative rotorcraft fuselage configuration.	Fundamental Aeronautics

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics

Performance

Performance Commitments:

Measure #	Description	Contributing Program (s)
Outcome 4.2	**Conduct systems-level research on innovative and promising aeronautics concepts and technologies to demonstrate integrated capabilities and benefits in a relevant flight and/or ground environment.**	
Objective 4.2.1	**Develop advanced tools and technologies that reduce the technical risk associated with system-level integration of promising aeronautical concepts.**	
Performance Goal 4.2.1.1	***Reduce technical risk by conducting research at an integrated system-level on promising aeronautical concepts and technologies in a relevant environment.***	
APG 4.2.1.1: AR-12-12	Demonstrate low-weight, damage-tolerant stitched composite structural concept on curved panel subjected to combined tension and internal pressure loads.	Integrated Systems Research
APG 4.2.1.1: AR-12-13	Develop integrated Human Systems Integration, Communications, and Separation Assurance subproject test concept and Phase 2 test objectives necessary to achieve human-in-the-loop simulation and flight test series milestones supporting the Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project.	Integrated Systems Research
Strategic Goal 5	**Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.**	
Outcome 5.3	**Ensure the availability to the Nation of NASA-owned, strategically important test capabilities.**	
Objective 5.3.2	**Ensure that Aeronautics Test Program (ATP) facilities are available and capable of supporting research, development, test and engineering goals and objectives for NASA and national aerospace programs.**	
Performance Goal 5.3.2.1	***Ensure that testing capabilities are available in order to support the research, development, test, and engineering milestones of NASA and Department of Defense (DoD) programs.***	
APG 5.3.2.1: AR-12-14	Achieve ratings greater than 86 percent for overall quality and timeliness of Aeronautics Test Program (ATP) facility operations.	Aeronautics Test

Uniform and Efficiency Measures:

Measure #	Description
Aeronautics Theme	
APG EFF: AR-12-16	Deliver at least 86 percent of on-time availability for operations and research facilities.

Performance Achievement Highlights:

ASP partnered with FAA, Sensis, Boeing, United Airlines, and Continental Airlines to conduct joint simulations of continuous descent approaches in a congested environment with time based metering at the Denver Air Route Traffic Control Center. Using the Efficient Descent Advisor (EDA) decision support tool, the controllers enabled reduced fuel and noise operations through efficient descent procedures under heavy traffic conditions. The results of this simulation will guide the development of the EDA Technology Transition Document for delivery to the FAA in support of investment decisions.

AvSP published guidelines on automation, displays, and alerting technologies for use by designers of future aircraft cockpits, which are needed by the aviation community to safely meet NextGen operational needs. These guidelines are based on data collected via human-in-the-loop studies with real flight crews in simulations of the higher traffic densities and the operation environment of NextGen. By providing these results to industry-wide and FAA-sponsored technical committees, NASA contributes to authorized operational requirements and certification standards for new technologies and procedures.

FAP made progress toward enabling technologies that address many challenges for commercial aircraft with entry-into-service in the 2030-2035 timeframe (N+3). The program worked with industry and academia to explore revolutionary aircraft solutions to address energy efficiency, environmental compatibility, operations and determine high-payoff technologies and research opportunities to enable these solutions. Pivotal analyses resulting from the N+3 Concept Studies will be used to guide NASA's long-term technology investments for future green aviation air vehicles. Important insight was gained in critical technologies including flow control, light-weight and higher temperature materials, and aeroelastic structures that are broadly applicable to commercial aircraft.

ATP developed an ice generation system for the Propulsion Systems Laboratory (PSL) at Glenn Research Center. This system is capable of replicating high-altitude ice crystal ingestion phenomena and will enable testing to help researchers understand conditions associated with in-flight, ice crystal ingestion and accumulation in commercial jet engines at high altitude cruise conditions. Results included the first-ever demonstration of ice crystal generation under conditions that replicate high-altitude cruise conditions. This facility improvement addresses one of the 12 critical shortfalls identified in the National Infrastructure Plan.

ISRP completed the first phase of flight tests on the low speed X-48B Blended Wing Body (BWB) aircraft at the Dryden Flight Research Center. The X-48B is a 500 pound, 8.5 percent-scale aircraft of a potential, full-scale BWB type aircraft that has the silhouette of a manta ray. The vehicle is remotely piloted and enables NASA to assess and validate this advanced vehicle concept as well as key technologies. The 80 flights completed in Phase I provided insight into the handling and flying qualities of such an aircraft at speeds typical of landings and takeoffs.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics

Independent Reviews:

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Relevance	Expert	10/2008	An assessment of NASA's aeronautics research portfolio was performed by the National Research Council to determine how NASA is addressing the research challenges identified in the decadal survey of civil aeronautics. It found that NASA is addressing most of the 51 challenge areas but noted concerns about the lack of research in several areas, including unmanned aircraft systems (UAS) integration in the NAS. NASA is addressing this issue with the new UAS Integration in the NAS project.	N/A

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Aviation Safety

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**74.0**	**-**	**48.5**	**47.8**	**46.7**	**45.4**	**44.0**
Aviation Safety	74.0	-	48.5	47.8	46.7	45.4	44.0

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Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Aviation Safety

Program Overview

AvSP performs research and develops advanced technologies to improve the overall safety of the future air transportation system.

The current U.S. air transportation system is widely recognized as among the safest in the world. Over the past 10 years, the commercial accident rate has continued to drop, a credit to industry and government working together to solve problems and proactively identify new risks. However, the demand for air traffic is expected to continue to increase substantially in the next 15 to 20 years, and while NextGen will meet this demand by making passage through the increasingly crowded skies efficient and speedy, it will come with increased reliance on automation and increased operating complexity. Therefore, the vigilance of the aviation community must continue in order for the United States to meet the public expectations for safety in this complex, dynamic domain. To meet the challenge, AvSP develops cutting-edge technologies to improve the intrinsic safety of current and future aircraft that will operate in NextGen. AvSP's contributions range from providing fundamental research and technologies on known or emerging safety concerns, to working with partners in developing new capabilities for NextGen.

AvSP transfers knowledge and technology to the aviation community for both hardware and software systems. The program increases capabilities to predict and prevent safety issues by developing capabilities to monitor for safety issues and minimize them should they occur; designing safety issues out of complex systems and system behaviors; and analyzing designs and operational data for potential hazards. One objective of the program is to assure system wide safety. To that end, AvSP is pursuing methods and tools to overcome the challenges in verifying and validating that new, complex NextGen systems meet the extremely high levels of safety required. AvSP is also developing methods for discovery of safety issues via data mining, and further developing human performance models to be applied in the design of automation.

Another objective is to advance the state-of-the-art of aircraft safety in key areas. Thus, AvSP is developing ways to maintain and ensure vehicle health and airworthiness, crew-system interaction concepts that provide situational awareness and sound decision making, and methods to detect, avoid and protect against loss-of-control events. A final objective is to address the inherent presence of atmospheric risks (e.g., in-flight icing and other atmospheric effects), accomplished by investigating their sources and providing technologies so that those hazards do not compromise flight safety.

AvSP has developed research plans with milestones and metrics in three technology areas. All areas emphasize proactive methods and technologies and utilize a systems analysis approach for identifying key issues and maintaining a portfolio of activities leading to potential solutions to the issues. To improve its processes to define program goals, prioritize the research portfolio, and maintain close coordination with external agencies, as identified in the findings of the National Research Council's "Advancing Aeronautical Safety" study, AvSP will actively work with the NASA Advisory Committee's (NAC's) Aeronautics Committee and through the annual program review process to review and assess relevance of goals. AvSP will also fully participate in the Mission Directorate's strategic assessment activities to analyze and prioritize future investments across all programs, which will augment AvSP's own systems studies to help prioritization of program investment. AvSP will strengthen coordination with external agencies through more active participation in JPDO, Commercial Aviation Safety Team (CAST), RTCA, Inc., and others in addition to on-going coordination.

Fore more information, please see http://www.aeronautics.nasa.gov/programs_avsafe.htm.

Plans For FY 2012

Highlighted below are key goals for FY 2012.

- AvSP will demonstrate static code analysis techniques for use by software developers and equipment manufacturers to assist in the certification of software. The program will deliver a prototype static analyzer which produces less than 10 percent false positives, publish the algorithms, and submit results in peer-reviewed conferences or journals.

- The program will develop a concept of operations for an integrated vehicle health assurance system. During FY 2012, the program will develop, document, and provide to the aviation user community, an integrated system concept for vehicle health assurance that fully integrates ground-based inspection and repair information with in-flight measurement data for airframe, propulsion, and avionics subsystems.

- AvSP will develop a first-generation engine icing performance degradation parametric simulation capability. In FY 2012, the program will develop an engine system modeling code with simulated ice blockages effects and evaluate its predictive capability of engine performance with anticipated blockage effects due to accretion at assumed altitudes. In addition, the program will check out instruments for scientifically confirming the envelope of high-altitude ice crystal conditions and conduct initial calibration of one-of-a-kind ground test capability. AvSP will also develop a standardized lightning test procedure to support the future development of improved composite protection methods.

- AvSP will incorporate the National Research Council's "Advancing Aeronautical Safety" findings related to program goal definition, internal prioritization, and external coordination with other agencies to continue to strive for continued excellence and improved efficiency in aviation safety research.

Project Descriptions and Explanation of Changes

System-Wide Safety and Assurance Technologies

The goal of system-wide safety and assurance technologies research is to provide knowledge, concepts and methods to proactively manage increasing complexity in the design and operation of vehicles in the air transportation system. To meet this goal, the following challenges are being addressed through 2016:

- Safely incorporating technological advances in avionics, software, automation, and concepts of operation by developing verification and validation tools for manufacturers and certifiers to use to assure flight critical systems are safe in a rigorous and cost- and time-effective manner;

- Understanding and predicting system-wide safety concerns of the airspace system and vehicles by developing technologies that can use vehicle and system data to accurately identify precursors to potential incidents or accidents;

- Predicting the life of complex systems by developing technologies that can reason under uncertainty about root causes, predict faults and remaining useful life across multiple systems, and aid decision making across multiple systems; and

- Improving operator effectiveness within aviation systems by developing understanding of human performance key parameters that mediate human contributions to safety in aviation.

Vehicle Systems Safety Technologies

The goal of vehicle systems safety technologies research is to identify risks and provide knowledge needed to avoid, detect, mitigate, and recover from hazardous flight conditions, and to maintain vehicle airworthiness and health. To meet this goal, the following challenges are being addressed through 2016:

- Assessing the health of aircraft at the material, component, and subsystem level more efficiently and effectively by developing health-management tools and systems to determine, predict, mitigate, and manage the state of degradation for current and future airframe, propulsion, and avionics subsystems;

- Addressing loss-of-control events that may be induced by unintended entry into unusual flight conditions, response to on-board failures, and/or environmental hazards. NASA will develop, assess, and validate methods for avoiding, detecting and resolving conditions that can lead to loss-of-control in current and future vehicle operations; and

- Appropriate operator situational awareness in off-nominal situations (including on the ground) by developing tools and concepts for future flight deck designs that promote effective human-automation interaction and error recovery.

Atmospheric Environment Safety Technologies

The goal of atmospheric environment safety technologies research is to investigate sources of risk and provide technology needed to help ensure safe flight in and around atmospheric hazards. To meet this goal, the following challenges are being addressed through 2016:

- Addressing the atmospheric hazard of in-flight icing, of both engine and airframe, in cooperation with the icing community to characterize the various icing environments, develop remote sensors to detect conditions, understand and model the effects of ice accretion, and support the development of methods to mitigate the conditions; and

- Sensing and mitigating other risks associated with other atmospheric hazards that pose serious threats to aviation.

Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
In 2014, develop simulation capabilities, tools, and test methods that improve understanding of engine performance under high ice-crystal water content conditions.	Aviation Safety	Updated to reflect program restructure
In 2016, identify and develop tools, methods, and technologies for improving overall aircraft safety of new and legacy vehicles operating in the NextGen.	Aviation Safety	No change

Program Management

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD and NASA programs.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Aviation Safety	Program Director	ARC, DFRC, GRC, LaRC	A&P Technology, Alcoa Technical Center, ANSYS, Boeing, Cal Poly Corp, CAST (Commercial Aviation Safety Team), Cessna Aircraft Co., DOD, DLR (Deutsches Zentrum für Luft- und Raumfahrt), easyJet, Environment Canada, ExpressJet, FAA, General Electric Aircraft Engines, Goodrich, Honeywell, INTA (Instituto Nacional de Técnica Aerospacial), JPDO, Luna Innovations, Moog, NLR (National Aerospace Laboratory of the Netherlands), National Oceanic and Atmospheric Administration, NRCC (National Research Council Canada), New Mexico State University, ONERA, Siemens, United Technologies Corp., University of Nebraska, Wichita State University

Acquisition Strategy

AvSP spans research and technology from foundational research to integrated system-level capabilities. This broad spectrum necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

A full and open NRA is used as the means to solicit innovative proposals in key research areas that compliment NASA expertise. One of the main objectives of the NRA investment is to stimulate close collaboration among NASA researchers and NRA award recipients to ensure effective knowledge transfer. AvSP awards grants, contracts, and cooperative agreements, including renewals of multi-year awards with industry, academia, and non-profit institutions. These awards also help to strengthen the research capabilities that are of interest to NASA within the recipient organizations and institutions. The program also utilizes partnerships with cost sharing and in-kind contributions to gain access to system-level research and integration opportunities.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Aviation Safety

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Expert Review	11/2010	The 12-month review is a formal independent peer review. Experts from other Government agencies report on their assessment of technical and programmatic risk and/or program weaknesses. In the FY 2010 review, the independent review panel rated AvSP as "Very Good" overall.	11/2011
Relevance	National Research Council	7/2010	To assess if AvSP has appropriate research objectives; is coordinated with the FAA and other federal safety programs; has appropriate resources for each objective; and has mechanisms for transitioning program results in a timely manner. Findings show AvSP continues to contribute to aviation safety, but the processes for choosing, prioritizing, and coordination of its areas of research need improvement. Recommendations were incorporated into the reorganized program.	N/A

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Airspace Systems

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**79.0**	**-**	**70.3**	**69.4**	**67.7**	**65.8**	**63.8**
Airspace Systems	79.0	-	70.3	69.4	67.7	65.8	63.8

Note:
The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Airspace Systems

Program Overview

Increasing the capacity and efficiency of the air transportation system in a manner that has minimal impact on the environment or aviation safety is critically important to the Nation's economic well being. More than half of the Nation's busiest airports are already at capacity or are expected to reach capacity limits in the next 10 to 20 years. Creating new capacity en route or on the airport surface is extraordinarily expensive and can take decades to complete, particularly when environmental constraints and safe aircraft separation standards are at issue.

Despite capacity constraints, air traffic is expected to continue to increase substantially over the next twenty years. The associated environmental impact and economic inefficiencies have been predicted to cost the Nation tens of billions of dollars annually. The risk of accidents caused by aircraft coming too close to one another, during airborne or ground operations, could increase as the volume of air traffic exceeds the capacity of the airspace and airports to safely and efficiently accommodate the increased growth.

ASP, in collaboration with other member agencies of JPDO, directly addresses the air traffic management research needs of NextGen. NASA collaborates with other Government agencies, industry, and academic partners to bring the best and the brightest talent and ideas to address the technical challenges and improve technology transfer to the users of its research products.

These new technologies will allow significant increases in capacity, efficiency, and flexibility of the NAS and support the guidelines in the National Aeronautics Research and Development Policy and Plan. These advanced concepts and technologies will determine future roles and responsibilities for air traffic management functions performed by humans and automation in the aircraft and on the ground. The concepts will reduce delays caused by adverse weather. The research will reduce noise, emissions, fuel consumption, and delays through automation, which will provide the most optimum aircraft flight paths and non-stop taxiing. In addition, system safety will be enhanced on the ground through automated aircraft based runway/taxiway collision avoidance and in the air through automated signaling and recommendations for avoidance of conditions in which aircraft come too close to one another and compromise safety. Furthermore, the research will enable the seamless operation and utilization of the full potential capabilities of new aircraft types such as advance rotorcraft, UAS, supersonic aircraft, and hybrid wing body.

For more information, please see http://www.aeronautics.nasa.gov/programs_asp.htm.

Plans For FY 2012

ASP conducts NextGen concepts and technology development, and the corresponding systems analysis, integration, and evaluation.

NextGen concept and technology development research focuses on developing capabilities in traffic flow management, dynamic airspace configuration, separation assurance, super density operations, and airport surface operations. Key aspects include optimization for traffic scheduling and route planning, and balanced allocation of resources to maximize airspace productivity in response to arrival, departure, and surface traffic demands. Selected off-nominal situations (e.g., weather impacts) will be studied. Technical concepts included in this activity are continuous descents, runway balancing, precision terminal area scheduling and control, surface optimization, efficient flow management, and merging and spacing. In FY 2012, ASP will develop initial weather translation models for incorporation in traffic flow management decision support tools to better manage the weather-impacted traffic capacity.

NextGen systems analysis, integration, and evaluation will focus on transitioning key systems concepts from the laboratory to the field. The NextGen concept and technology development area will provide operational benefits and demonstrate these integrated capabilities in relevant flight environments. Through systems analysis, key concepts will be down-selected based on their potential benefit to improve operational efficiency and then matured and tested in laboratory simulations to determine their technical viability. A subset of these integrated concepts will be further demonstrated and evaluated through field tests integrating both air and ground capabilities. Coordination with the FAA, JPDO, and Research Transition Teams (RTT) will ensure transition of NASA concepts, technologies, and procedures to the field to enable transition of today's air transportation system to NextGen. In FY 2012, ASP will evaluate interval management procedures that enable aircraft to self-manage arrival merging and spacing to a single airport with dependent parallel runways.

Both research areas described above contribute to the Agency's High Priority Performance Goal to increase efficiency and throughput of aircraft operations during arrival phase of flight. In FY 2012, ASP will deliver the EDA technology transition documentation to FAA. The EDA prototype supports real-time decision making by presenting speed and path adjustment advisories to air traffic controllers. EDA helps save hundreds of pounds of fuel and carbon dioxide emissions per participating flight, while reducing noise over surrounding communities by selecting optimal descent speeds and paths for arriving aircraft under heavy traffic conditions. EDA is a key component of FAA's 3D-Path Arrival Management Program and NextGen. The primary mechanism for transfer is the NASA-FAA RTT.

Acceleration of air traffic management technology transition through advanced development and demonstrations has been identified as key to meeting the Nation's air transportation needs by the National Aeronautics R&D Plan, NextGen Integrated Work Plan, and other Federal stakeholders. In FY 2012, ASP will initiate an industry and government collaborative effort to further advance greater utilization of Automatic Dependent Surveillance-Broadcast application technologies. The target opportunity will involve integration of technologies from ASP's current portfolio to provide optimization of airport surface movements with precise scheduling to reduce both surface and en-route traffic delays. Candidate technologies will be vetted through discussion of system benefit potential with airspace users. Focus of the work will be maintained on delivering validated operational improvements employing low-cost, simple, short-term, high-fidelity simulations and field trials.

Project Descriptions and Explanation of Changes

NextGen Concepts and Technology Development

Researchers of NextGen concepts and technology develop and explore fundamental concepts that address the optimal allocation of ground and air automation technologies necessary for NextGen. Research in ASP addresses four-dimensional trajectory operations from strategic planning stages to separation assurance, including advances in the science and applications of multi-aircraft trajectory optimization that takes into account weather information and forecast uncertainties across the spectrum of time horizons. The program also conducts research to explore dynamic airspace configuration that addresses the technical challenges of migrating from the current structured, static homogenous airspace to a dynamic, heterogeneous airspace that adapts to user demands and meets changing constraints of weather, traffic congestion, and a highly diverse aircraft fleet. Ultimately, the roles and responsibilities of humans and automation influence every technical area and will be addressed thoroughly. The program responds to the need to achieve the maximum possible productivity in the combined use of gates, taxiways, runways, terminal airspace, and other airportal resources. Specific technical goals include:

- Increasing capacity through dynamic allocation of airspace structure and controller resources;
- Effectively allocating demand through departure-time management, route modification, adaptive speed control, etc., in the presence of uncertainty;
- Developing algorithms, automation prototypes, and procedures that relieve the capacity constraints imposed by human-controlled separation of aircraft in transition and cruise airspace;
- Quantifying the performance-enhancing effects of emerging airborne technologies;
- Optimizing airport surface traffic operations to enable capacity enhancements;
- Maximizing the capacity of individual runways and multiple runways with airspace and taxi interactions (i.e., closely-spaced parallel and converging or intersecting runways);
- Minimizing runway incursion threats in all weather conditions; and
- Balancing arrival and departure traffic management to enable capacity improvements.

NextGen Systems Analysis, Integration, and Evaluation

The high-level goal of the NextGen systems analysis, integration, and evaluation research is to identify, mature, and test key concepts and technologies based on their potential benefit towards increasing system efficiency. To accomplish this goal, the following technical objectives will be satisfied:

- Define operational issues, factors, and concerns that must be considered in conducting system analysis;
- Assess collective impact of mature technologies using fast-time modeling and simulation and feed back results into the baseline program to enhance and validate research concepts;
- Examine the feasibility of the integrated concepts and technologies using human performance models and human-in-the-loop simulations;
- Demonstrate the impact of the integrated concepts and technologies using field trials;
- Assess alternate fleet implications on trajectory-based operations;
- Collaborate with industry and Government partners to transition technologies that enable increases in capacity and efficiency, while maintaining safety and environmental conditions; and
- Integrate technologies from the current portfolio to further advance greater utilization of Automatic Dependent Surveillance-Broadcast (ADS-B) application technologies, thus providing optimization of airport surface movements with precise scheduling to reduce surface and en-route traffic delays and enhance safety.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Airspace Systems

Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
In 2013, develop conflict alert capability for terminal operations to increase throughput and safety.	Airspace Systems	No change
In 2015, define allocation of air traffic control functions between air- and ground-based on human-in-the-loop (HITL) simulation studies involving nominal and off-nominal scenarios.	Airspace Systems	No change
In 2017, complete integrated testing involving ground-based scheduling and flight deck merging and spacing.	Airspace Systems	No change

Program Management

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD and NASA programs.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Airspace Systems	Program Director	ARC, LARC	FAA, JPDO, DOT, Air Force Research Lab (AFRL)

Acquisition Strategy

ASP spans research and technology from foundational research to integrated system capabilities. This broad spectrum necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

A full and open NRA is used as the means to solicit innovative proposals in key research areas that complement NASA expertise. One of the main objectives of the NRA investment is to stimulate close collaboration among NASA researchers and NRA award recipients to ensure effective knowledge transfer. ASP awards grants, contracts, and cooperative agreements, primarily with industry, academia, and non-profit institutions. These awards also help strengthen the research capabilities that are of interest to NASA within the recipient organizations and institutions. The program also utilizes partnerships with cost sharing and in-kind contributions to gain access to system-level research and integration opportunities.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Airspace Systems

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Expert Review	11/2010	The 12-month review is a formal independent peer review. Experts from other Government agencies report on their assessment of technical and programmatic risk and/or program weaknesses. In the FY 2010 review, the independent review panel rated ASP as "Excellent/Very Good" overall.	11/2011

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Fundamental Aeronautics

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**199.0**	**-**	**97.2**	**95.9**	**93.6**	**90.9**	**88.2**
Fundamental Aeronautics	199.0	-	97.2	95.9	93.6	90.9	88.2

Note: The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

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Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Fundamental Aeronautics

Program Overview

FAP develops new aircraft that will fly faster, cleaner, and quieter, and use fuel far more efficiently as the Nation transitions to a more modernized air transportation system. FAP research affects all flight regimes, addressing:

- Public concern over noise and emissions;
- The sustainability of affordable air travel given the fluctuating cost and availability of jet fuel; and
- Requirements for increasing mobility even as the NAS grows more crowded.

FAP conducts research in four specific flight regimes.

- The two subsonic regimes address advanced fixed wing and subsonic rotary wing (SRW) aircraft.

Subsonic fixed wing (SFW) research focuses on new aircraft configurations, advanced propulsion systems, and enabling technologies to dramatically reduce noise, emissions, and fuel burn. Subsonic rotary wing research targets speed and range increases, payload capacity, noise reduction, and propulsive efficiency. Envisioned future rotorcraft will enable further increases in moving people and goods through the national airspace system. In both cases, subsonic and rotorcraft vehicles will be dramatically quieter and will fly very efficiently, burning far less fuel.

- A third flight regime is supersonics. Technologies to meet the environmental challenges specifically associated with faster-than-sound flight, such as sonic boom and emissions, are addressed by FAP's supersonics research. Elimination of such barriers would enable routine overland commercial supersonic flight.

In addition, FAP is creating and maturing technology approaches to 21st century supersonic commercial airplanes. Their introduction into service could one day reduce domestic and international flight times dramatically, with environmental impacts on par with other aircraft.

- A fourth flight regime is hypersonics. Hypersonics research focuses on long-range, fundamental research to enable very high speed air-breathing vehicles. New hypersonics approaches could ultimately enable rapid transoceanic and transcontinental flight, with improved reliability for lower-cost and more routine access to space, and result in new technologies that enable high-mass entry into atmospheres.

FAP research also includes the creation and maturation of tools and technologies to enable hypersonic vehicles. Their development may one day make air-breathing access to space possible, while simultaneously enabling entry and descent into a variety of planetary atmospheres.

Ultimately, FAP research enables a future in which a variety of advanced vehicles improve the flexibility, efficiency, and environmental impacts of the air transportation system. The program is dedicated to developing the tools, technologies, and scientific knowledge needed to design novel air vehicles that do not exist today.

For more information, please see http://www.aeronautics.nasa.gov/fap.

Plans For FY 2012

Plans for the study of the four fundamental aeronautics flight regimes include:

- SFW research will focus on multidisciplinary analysis of technologies and toolsets needed to achieve reductions in noise and emissions along with significant improvements in efficiency. Essential to this research will be improvements in prediction tools and new experimental methods that provide fundamental physics data/properties and establish validation data and identification of key driving technologies (including advanced materials and aerodynamics predictions). SFW research will characterize gaseous and particulate emissions of alternatives to current jet fuel that will aid reducing the carbon dioxide contribution from air transportation, including preparations for future flight tests with alternative fuels. SFW research will also demonstrate the application of a system-level, multi-fidelity, multidisciplinary analysis/optimization framework for conventional and unconventional subsonic transport vehicles, which is important for creating a design capability for truly revolutionary configurations.

- SRW research will result in demonstrating new technologies to enable high-speed, efficient rotorcraft. Capitalizing on new facilities and hardware investments, SRW will demonstrate concepts for variable speed transmissions on small- to mid-scale test articles. These concepts will enable efficient operation over a wide speed range for the engine and transmission system, as variable rotor speed has been identified as a critical technology for high-speed rotorcraft configurations. In addition, the project will prepare the tiltrotor test rig for use in advance research in large, advanced tiltrotor configurations. The goals of advancing technologies leading to high-speed rotorcraft will be accomplished through improvement of design and analysis tools and validation of those tools with unique data obtained in NASA and partner facilities. In FY 2012, an area of focus will be to improve the understanding of drag reduction benefits of active flow control technologies, which can make a variety of rotorcraft vehicles more efficient.

- Supersonics research will complete data analysis and reporting for a large-scale wind tunnel test of a propulsion system inlet design that incorporates low boom design features and employs flow control devices to improve performance and efficiency. The analysis will include comparisons of experimental data with computational fluid dynamics (CFD) data. These data, and the technology concepts embodied in the test model, will enable the design of future supersonic propulsion systems that are an essential part of a highly integrated aircraft that meets the efficiency and environmental goals for a new generation of civil supersonic transports. The project will also complete the first phases of experimental computational code validations and technologies for designing the eternal shape of aircraft concepts that produce very low sonic boom noise and high cruise efficiency. The experimental and analytical assessments will involve wind tunnel to CFD comparisons for full configuration geometries. The project will also conduct research on advanced high temperature materials that enable better performance in future supersonic and subsonic aircraft.

- Hypersonics research will enable more accurate CFD predictions of ramjet-to-scramjet mode transition and will validate these predictions by comparisons with wind tunnel and/or flight data. The ability to accurately predict scramjet performance under mode-transition fueling levels is a key enabler for the design of efficient hypersonic air-breathing propulsion systems. This CFD assessment activity will validate and verify the accuracy of propulsion CFD codes. Additionally, the first generation multidisciplinary integrated design and engineering analysis tool suite will achieve operational status, and will be validated on the NASA air-breathing two-stage-to-orbit reference vehicle.

Project Descriptions and Explanation of Changes

Subsonic Fixed Wing (SFW)

SFW research enables advances to future generations of fixed wing vehicles, with primary focus on "N+3" vehicles (i.e., three generations beyond current state-of-the-art aircraft), which will require mature technology by FY 2030. Because enhanced N+3 performance requires significantly improved energy efficiency to reduce fuel burn and improve operational technologies, progress in this area holds the promise of emissions reduction not just in the long term, but within the coming decade.

SFW provides technologies, novel test methods, and validated prediction tools to improve system trades for advanced concepts capable of meeting longer-term noise, emissions and performance targets. For example: FAP's SFW alternative-fuels research is focusing on characterization of synthetic fuels and biofuels in order to understand their impact on engine combustor design, performance, and emissions.

SFW continues to pursue the following goals:

- Improve prediction tools and new experimental methods to understand fundamental properties and establish validation data;

- Develop noise-prediction and noise-reduction technologies for airframe and propulsion systems that will enable up to -71 decibel (dB) cumulative, below Stage 4, which is a limit imposed by the International Civil Aviation Organization on the maximum allowable noise levels for current aircraft;

- Devise emissions-reduction technologies and prediction tools to achieve a 70+ percent reduction in landing and take-off nitrogen oxide levels-- below the "sixth state" of regulation recommended by the Committee on Aviation Environmental Protection;

- Improve vehicle performance through design and development of lightweight, multifunctional and durable structural components, low-drag aerodynamic components, advanced aircraft configurations, and higher bypass ratio engines with efficient power plants in order to enable a fuel burn reduction of more than 70 percent as compared to today's state-of-the-art commercial subsonic transport; and

- Create multidisciplinary design and analysis tools and processes to enable design of advanced aircraft configurations with a greater degree of confidence.

Subsonic Rotary Wing (SRW)

Each of the two broad classes of rotary wing vehicles has factors that limit their respective cruise speeds. The primary limiting factor for the cruise speed of helicopter configurations has been the dynamic stall encountered on the retreating side of the rotor as the forward speed is increased. The limiting factor for the cruise speed of tiltrotors has been prop-rotor efficiency, as designs typically trade cruise efficiency for hover performance, with a prop-rotor speed reduction of nominally 15 percent from hover to cruise in current vehicles.

SRW research will enable improved prediction methods and technologies for increasing cruise speed, range, and payload while decreasing noise and emissions of rotary wing aircraft. FAP has set aggressive goals to develop technologies that enable high-speed, efficient rotorcraft of various sizes and configurations to be viable commercial vehicles operating in the national airspace.

SRW research includes the following goals:

- Make rotorcraft competitive with fixed wing aircraft for short- and medium-range missions by enabling variable-speed rotor concepts that incorporate the ability to change rotor rotational speed by 50 percent, while retaining propulsion efficiency to enable optimum rotor aerodynamic performance in both hover and higher forward flight speeds;

- Contain external noise within the landing area, reduce internal noise to less than 77 dB, and develop scenarios for low-noise rotorcraft flight operations;

- Assess multiple active rotorcraft concepts for effectiveness in simultaneously increasing aerodynamic efficiency, controlling dynamic stall control for high-speed conditions, reducing vibration, and reducing noise. The goal for high speed is to increase the state-of-the-art cruise speed for any rotary wing configuration by 100 knots while maintaining low-vibration and low-noise characteristics;

- Advance technologies such as crashworthiness, safe operations in icing conditions, and condition-based maintenance methodologies to ensure that rotary wing vehicles remain viable commercial transport concepts; and

- Develop the next generation of rotorcraft analysis and design tools based on first-principles modeling rather than empirical methods. The objective is to ensure design tools are accurate for any configuration, that they can be used on any hardware platform, and that they are scalable to the future of parallel computing developments. This will reduce design cycle cost while increasing confidence in new-design performance.

Supersonics

The Supersonics project will develop improved prediction methods and technologies to enable the elimination of barriers that today prevent practical, commercial supersonic flight. NASA's supersonics research is organized along the following major technical challenges:

- Efficiency: Supersonic cruise, light weight, and durability at high temperature;

- Environment: Airport noise, sonic boom and high-altitude emissions;

- Performance: Aero-propulso-servo-elastic analysis and design, and cruise lift/drag ratio; and

- Multidisciplinary design, analysis and optimization.

The project's focus is to mature the technologies necessary to enable overland supersonic cruise for civilian applications with minimal environmental impact from sonic boom, airport noise, and high-altitude emissions. NASA's supersonics research should result in:

- Airframe and propulsion-system cruise-efficiency improvements that will increase the range factor (miles/lb of fuel consumed) to 30 percent higher than "best achieved" in low-sonic-boom designs made during NASA's High-Speed Research Program;

- Reductions of propulsion-system noise to a level of 10 to 15 dB effective perceived noise, below that of aircraft certified to Federal Aviation Regulations Part 36 Stage 3 noise standards;

- A reduction of loudness to a level of 65-70 dB perceived loudness for small supersonic aircraft; and

- Minimization of impact from high-altitude emissions.

Hypersonics

The scope of the hypersonics research project has been reduced and will focus on foundational hypersonic research areas where NASA supports unique core competencies and technologies. The revised portfolio is directly responsive to the National Aeronautics Research and Development Plan goal for demonstrating sustained, controlled hypersonic flight. NASA will retain key elements of the portfolio for expanding the foundational knowledge of air breathing propulsion systems and re-entry system technologies that are enabling for future NASA and commercial systems. NASA's hypersonics research is motivated by the reality that all access to Earth or planetary orbit, and all entry from orbit into any atmosphere, requires sustained, controlled flight through the hypersonic regime. NASA's Hypersonics project is addressing the technical challenges for two high-payoff technology areas: Hypersonic Air-breathing Vehicle Technologies (HAVT) and Entry, Descent and Landing Technologies (EDLT). Cutting-edge hypersonics research on HAVT will enable sustained, air-breathing, powered hypersonic flight through the atmosphere for space access or other applications. HAVT research will enable new air-breathing launch vehicles such as two-stage-to-orbit systems to eventually provide more routine low-cost access to space. The research focused on EDLT will result in the development of foundational tools and knowledge that enable significant improvements in performance of future re-entry systems.

The FAP will focus its hypersonics research on addressing that speed regime's most difficult technological challenges, including:

- The development of accurate predictive tools and models for high-speed compressible flow including turbulence, heating, ablation, combustion, and their interactions in order to reduce the uncertainty in predictions of aerodynamic heat loads during the design of hypersonic vehicles. This improved knowledge and predictive capability will result in lower vehicle weight due to reduced design margins for thermal structures and thermal protection systems;

- Knowledge and tools to enable air-breathing propulsion systems that operate efficiently over a very wide speed range and that can be scaled up from the current state of the art; and

- The development of materials and structures for applications that can withstand the severe temperatures encountered in hypersonic flight for extended periods of time.

Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
In 2017, integrate higher fidelity hypersonic discipline design tools to reduce design time and increase design space.	Fundamental Aeronautics	Updated to reflect restructured hypersonics research
In 2018, validate advanced cabin noise-reducing concepts for large, advanced rotorcraft.	Fundamental Aeronautics	No change
In 2018, demonstrate tools and technologies to reduce sonic boom to levels that allow supersonic flight over land and accurately assess the impact of sonic boom on community populations.	Fundamental Aeronautics	No change
In 2020, demonstrate through analysis and component testing technologies that enable a 50 percent fuel burn reduction and 50 percent CO2 emissions reduction for fixed wing aircraft.	Fundamental Aeronautics	No change

Program Management

The ARMD Associate Administrator has oversight responsibility for the FAP. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD or NASA programs.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Fundamental Aeronautics	Program Director	ARC, DFRC, GRC, and LaRC	Air Force Research Lab (AFRL), Boeing, Pratt & Whitney, Northrop Grumman, General Electric Aviation, Gulfstream Aerospace, United Technologies Corporation, Office of the Secretary of Defense, U.S. Army, U.S. Air Force, Center for Rotorcraft Innovation (CRI), Bell Helicopter, Sikorsky, Boeing, DARPA, FAA, ONERA, JAXA, DLR, Lockheed martin, Aerion Corporation, U.S. Air Force Office of Scientific Research (AFOSR), and U.S. Navy.

Acquisition Strategy

Acquisitions within FAP provide the basic elements for fundamental research, tools and methods development, enabling technologies, and validation and verification of research results. This broad spectrum necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

A full and open NRA is used as the primary means to solicit innovative proposals in key research areas that compliment NASA expertise. One of the main objectives of the NRA investment is to stimulate close collaboration among NASA researchers and NRA award recipients to ensure effective knowledge transfer. FAP awards grants, contracts, and cooperative agreements, primarily with industry, academia and non-profit institutions. These awards also help to strengthen the research capabilities that are of interest to NASA within the recipient organizations and institutions. The program also utilizes partnerships with cost sharing and in-kind contributions to gain access to system-level research and integration opportunities.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Expert Review	11/2010	The 12-month review is a formal independent peer review of the program. Experts from other Government agencies will report on their assessment of technical and programmatic risk and/or program weaknesses. Their recommendations will be received in a timely fashion and a response will be developed no later than six months after the review.	11/2011

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Aeronautics Test

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**65.6**	**-**	**50.7**	**50.0**	**48.8**	**47.4**	**46.0**
Aeronautics Test	65.6	-	50.7	50.0	48.8	47.4	46.0

Note: The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Aeronautics Test

Program Overview

U.S. leadership in aerospace depends on ready access to technologically advanced, efficient, and affordable aeronautics test capabilities. These capabilities include major wind tunnels, propulsion test facilities and flight test assets. The Federal Government owns the majority of these critical test capabilities in the United States, primarily through NASA and DOD. However, changes in the aerospace landscape (primarily the decrease in demand for testing over the last two decades) required an overarching strategy for the management of these national assets. In response, NASA established ATP as a two-pronged strategic initiative to: retain and invest in NASA aeronautics test capabilities considered strategically important to the Agency and the Nation, and establish a strong, high-level partnership to expand cooperation between NASA and DOD, facilitating the establishment of an integrated national strategy for the management their respective facilities. The national view or coordinated approach is becoming more important, specifically in addressing the challenges NASA and the Nation are facing, in terms of managing and evolving this large critical set of capabilities in a changing and increasingly demanding environment.

ATP facilities that comprise this set of critical capabilities are geographically dispersed across the United States. They are located at the Ames Research Center (northern California), Dryden Flight Research Center (southern California), Glenn Research Center (Ohio), and Langley Research Center (Virginia). These ATP facilities cover the flight envelope from subsonic through hypersonic and include unique capabilities ranging from simulating icing environments to modeling extreme dynamic situations. ATP offers Government agencies, the U.S. aerospace industry, and academic institutions unmatched research and experimental opportunities that reflect four generations of accumulated aerospace skill and experience. These capabilities encompass every aspect of aerospace ground and flight testing and all associated engineering.

ATP addresses opportunities and challenges, particularly with respect to the program's aging facilities, long-range forecasting of wind tunnel test demand, and determining the best approach to investing in new capabilities across the portfolio. A major FY 2012 focus for ATP is expanding the management structure upon which ATP was established in 2006. This includes a national view, reaching across agency boundaries (primarily DOD and NASA). It defines capabilities and joint technology efforts to address future requirements for NASA and the Nation. The National Partnership for Aeronautics Testing (NPAT) includes DOD and NASA and is the primary vehicle for addressing this national approach. These cross-agency partnerships are increasingly important as usage of NASA's and DOD's aeronautical test facilities continues to decrease despite increasing customer demand for improved test techniques and instrumentation. Broadening the scope of NASA's aeronautics testing program to include DOD provides additional value in ensuring the right capabilities are available to NASA and the Nation.

Looking to the future, ATP continues to implement its strategic plan. The plan was finalized in October 2009 and focuses in the following four areas:
- Providing management guidance and recommendations to the NASA ARMD Associate Administrator and Center Directors with respect to NASA aeronautics ground and flight test capabilities;
- Representing the strategic interest of NASA and the Nation with respect to stewardship of NASA ground and flight test capabilities;
- Providing direction to NASA test capability managers; and
- Ensuring that the right capabilities are available at the right time to meet the needs of NASA and the Nation.

For more information, see http://www.aeronautics.nasa.gov/atp.

Plans For FY 2012

In FY 2011, ATP acquired one Gulfstream III through GSA auction and three F15D aircraft from the U.S. Air Force. The Gulfstream III will address the increasing requirement to provide a test bed environment for subsonic regimes. Particular flight experiments in the Gulfstream III range from the addition of synthetic aperture radar to support Earth science experiments, to the addition of a glove to support aeronautics research into the practical benefits of laminar flow. The three F15D aircraft are to replace the aging F15 and F18 aircraft, while providing increased capability and maintainability of the support and test bed aircraft fleet. Basic modifications to the Gulfstream III and F15D aircraft are scheduled for completion by the end of FY 2012.

In FY 2012, ATP will implement the recommendations of the Capability Reliance Framework (CRF). The CRF is a top-level view of the suite of capabilities that ATP oversees and supports. It also includes similar capabilities within DOD and is an initiative executed under NPAT. The NASA and DOD partnership improves coordination and moves toward a national management structure that crosses agency boundaries. The resultant CRF framework will inform decision makers about capability needs, and how those needs would best be served by facilities and resources operated by NASA, DOD, and other entities. The primary outcome of CRF is the identification of gaps in capabilities, redundancies, and, most importantly, potential opportunities for consolidation. The current aerospace testing environment is one of decreasing customer usage across ATP and DOD testing facilities and increasing demands by customers for new capabilities. Consolidation would potentially allow scarce resources to be redirected to address capabilities needed for the future.

One of ATP's primary activities is ensuring the reliability and availability of its testing capabilities. The majority of ATP's FY 2012 budget will support day-to-day operations and facilities maintenance, including addressing breakdowns and necessary repairs.

Project Descriptions and Explanation of Changes

Flight Operations and Test Infrastructure

The flight operations and test infrastructure consists of an integrated set of elements, including the Western Aeronautical Test Range, which support aircraft maintenance and operations and the test bed aircraft that provide the resources required for research flight and mission support projects. ATP provides up to 100 percent of the facility fixed costs for these flight facilities to ensure facility and staff availability.

The activity also includes the simulation and flight loads laboratories, a suite of ground-based laboratories that support research flight and mission operations. ATP provides up to 20 percent of the fixed costs for laboratories, ensuring facility and staff availability.

Aero Ground Test Facilities

The aeronautics ground test facilities are different classes of facilities including low speed, transonic, supersonic, and hypersonic wind tunnels. Three primary efforts support the long-term viability of the facilities and to continually improve on the efficiency and effectiveness of safe, reliable, and productive operations:

- Facility operations support, which provides a portion of the fixed costs for ground test facilities to ensure facility and staff availability and user price stability;

- Facility maintenance and upgrades, which provides for maintenance and the upgrades that correct known deficiencies in facility safety, reliability, and productivity and enables the facilities to meet near -term and future testing requirements. These activities result in improved facility productivity and reduced operational cost; and

- Facility test technology, which develops and implements new technologies that increase test capability, improve productivity and efficiency, and improve data quality.

Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
Deliver at least 86 percent of on-time availability for operations and research facilities.	Aeronautics Test	No change

Program Management

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD or NASA programs.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Aeronautics Test	Program Director	ARC, DFRC, GRC, and LaRC	DoD

Acquisition Strategy

Acquisitions supporting ATP activity are performed at each of the test sites consistent with the FAR and the NASA FAR Supplement. Each Center is responsible for coordinating major acquisitions supporting ATP activities through the ATP Office as required by the ATP Director. Acquisitions that support the ATP facilities are usually less than $0.5 million and are initiated as early as possible in the fiscal year.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Relevance	Expert Panel	06/2010	Periodic reviews are carried out by the NAC and the U.S. users of ATP facilities. The last ATP review was carried out by the Aeronautics Committee of the NAC in July 2009; no major findings were reported. The last major community outreach meeting was held in April 2010 with NASA, DOD, and U.S. aerospace industry users at the Arnold Engineering Development Center. The next meeting is planned for September 2011.	07/2011
Performance	Expert Panel	11/2010	Periodic reviews are carried out by the NAC and the U.S. users of ATP facilities. The last ATP review was carried out by the Aeronautics Committee of the NAC in July 2009; no major findings were reported. The last major community outreach meeting was held in April 2010 with NASA, DOD, and U.S. aerospace industry users at the Arnold Engineering Development Center. The next meeting is planned for September 2011.	11/2011

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Integrated Systems Research

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**56.9**	**-**	**81.7**	**80.6**	**78.6**	**76.4**	**74.1**
Environmentally Responsible Aviation	56.9	-	58.4	57.0	55.1	53.1	50.1
UAS Integration in the NAS	0.0	-	23.3	23.6	23.6	23.3	24.0

Note:
The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Integrated Systems Research

Program Overview

ISRP conducts integrated system-level research on promising concepts and technologies to explore, assess, or demonstrate their benefits. ISRP evaluates these technologies through system-level experimentation and focuses specifically on maturing and integrating technologies into major vehicle and operations systems/subsystems for accelerated transition to practical application. The research in this program is coordinated with on-going, long-term, fundamental research within the other three research programs, as well as efforts of other Government agencies.

As air transportation demand grows and system capacity is enhanced, there is the potential for adverse environmental effects. Concerns over community noise and emissions may limit the capacity at some airports. NextGen is addressing these potential impacts through enhancements to airspace system operations and the vehicles that will operate in the NAS. Addressing these vehicle related environmental concerns is the driving impetus behind NASA's Environmentally Responsible Aviation (ERA) project. With a focus on advanced vehicles, ERA is conducting system-level research and experiments of promising vehicle concepts and technologies that simultaneously reduce fuel burn, noise, and emissions.

Through the ERA project, NASA focuses its research and development efforts to understand how advanced environmental technologies can best work in an integrated vehicle/aviation operations system. NASA engages the external research community by including traditional and non-traditional research partners. NASA initiates activities to expand its role in aviation alternate and biofuels research, ensuring parallel research in advanced engine combustor technologies keeps pace with advances in advanced fuels. In addition, NASA performs activities to determine if and how advances in air traffic management technologies can be exploited to mitigate adverse aviation effects on the environment.

NASA focuses on technologies to enable routine operations for UAS of all sizes and capabilities in the NAS. Specifically, NASA is addressing technology development in several areas to reduce the technical barriers related to the safety and operational challenges. The technical barriers include:

- Robust separation assurance algorithms;

- Command and control, and air traffic control communication systems;

- Consistent standards to assess UAS ground control stations; and

- Airworthiness requirements for the full range of UAS classes.

These technical barriers are formidable obstacles to meeting NASA's goals. NASA will validate data and technology through a series of high-fidelity HITL simulations (i.e., where a human is part of the simulation and influences the outcome) and flight tests conducted in a relevant environment. The project deliverables will help key decision makers in Government and industry make informed decisions, leading towards routine UAS access.

For more information, please see http://www.aeronautics.nasa.gov/programs_isrp.htm.

Plans For FY 2012

ERA has established goals and targets to simultaneously achieve significant reductions in community noise, fuel efficiency, and nitrous oxide emissions for commercial airliners. In support of these goals, NASA will conduct tests to validate low-noise characteristics of an energy-efficient unconventional aircraft concept, and demonstrate a low-weight, damage-tolerant, stitched-composite structural concept on large-scale structure in the NASA Combined Loads Test System facility. The project will also complete low speed flight controls research on X-48C and conduct discrete roughness elements glove flight tests on a Gulfstream G-III. In addition, Phase 1 of both the low nitrous oxide fuel flexible combustor study and the geared turbofan study will be completed. Finally, preliminary design of up to two advanced concept subscale test bed vehicles will be completed and down-selection to five to six integrated system-level demonstrations for Phase 2 of the project (FY 2013-FY 2015) will be made.

UAS integration in the NAS project will leverage UAS Executive Committee efforts, and work in collaboration with JPDO to develop a global civil UAS access roadmap. This roadmap is crucial to ensure efficient interagency cooperation, minimize unnecessary duplication of work, and maximize the opportunity to leverage research and development activities among Government and commercial industry. NASA's contributions include the development of a NextGen concept of operations, an analysis of the current state of the art for UAS, and a gap analysis between the two. FY 2012 deliverables also include a comparative analysis of certification methodologies and detailed descriptions and test plans for HITL simulations and integrated flight tests to be conducted in FY 2013 through FY 2015.

Project Descriptions and Explanation of Changes

Environmentally Responsible Aviation (ERA)

Research in environmentally responsible aviation explores and assesses new vehicle concepts and enabling technologies through system-level experimentation that simultaneously reduces fuel burn, noise, and emissions and thus reduces the impact of aviation on the environment. ISRP matures concepts and technologies, evaluates their performance at the system and sub-system level in a relevant environment, and identifies and assesses issues relative to safety. Through system-level analysis, promising advanced mid-term vehicle and propulsion concepts and technologies can be down-selected based on their potential benefit towards the stated national goals. Among the technologies to be explored are the following:

- Non-conventional aircraft architectures that enable reduced drag and shielding of propulsion system noise;

- Drag reduction through laminar flow;

- Advanced composite structural concepts for weight reduction;

- Low nitrous oxide combustors; and

- Propulsion/airframe integration for noise reduction and fuel burn improvements.

ISRP expands the well-informed design trade space for these types of technologies and transfers knowledge outward to the aeronautics community so that aircraft and propulsion system manufacturers can confidently transition these technologies into new products. The program also has the potential to transfer knowledge back to FAP so that concepts and technologies that do not yield predicted performance benefits can be further investigated and developed at a foundational level. This would occur only after an evaluation of such concepts and technologies indicates that further fundamental research is warranted.

UAS Integration in the NAS

There is an increasing need to fly UAS in the NAS to perform missions of vital importance to national security and defense, emergency management, science, and to enable commercial applications. One example is the use of a Predator UAS by the Department of Homeland Security to fly over the Nation's borders.

Current Federal aviation regulations are built upon the condition of a pilot being in the aircraft. There exist few regulations specifically addressing UAS, and the primary user of UAS to date has been the military. Because of this, the technologies and procedures to enable seamless operation and integration of UAS in the NAS need to be developed, validated, and employed by FAA through rule making and policy development.

The goal of the UAS integration in NAS research is to contribute capabilities that reduce technical barriers related to the safety and operational challenges of enabling routine UAS access to the NAS. This goal will be accomplished through a two-phased approach based on development of system-level integration of key concepts, technologies, and/or procedures, and demonstrations of integrated capabilities in an operationally relevant environment. The project will conduct integrated test and evaluation focusing on four technical challenges: separation assurance, communications, human systems integration, and certification.

The Phase 1 technical objectives include: developing a gap analysis between the current state of the art and the NextGen concept of operations; validating the key technical elements identified by the project requirements; initial modeling, simulation, and flight testing; and completion of sub-project Phase 1 deliverables (e.g., spectrum requirements, and comparative analysis of certification methodologies) and continuation of Phase 2 preparation (e.g., infrastructure and tools).

The Phase 2 technical objectives include: providing regulators with a methodology for developing airworthiness requirements for UAS, and data to support development of certifications standards and regulatory guidance; and providing systems-level, integrated testing of concepts and/or capabilities that address barriers to routine access to the NAS. Through simulation and flight testing, ISRP addresses issues including separation assurance, communications requirements, and human systems integration in operationally relevant environments.

Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
In 2014, complete community noise assessment of advanced hybrid wing body vehicle concepts from synthesis of experimental databases and noise prediction results.	Integrated Systems Research	No change
In 2015, develop and downselect vehicle concepts with the appropriate technology suite to simultaneously meet the N+2 fuel burn, community noise, and LTO NOx subsonic transport goals.	Integrated Systems Research	No change
In 2015, develop, validate and deliver robust simulation and flight test data for integrated technologies including separation assurance, communications, and human systems interfaces.	Integrated Systems Research	No change

Program Management

The ARMD Associate Administrator (AA) has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD or NASA programs.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Integrated Systems Research	Program Director	ARC, DFRC, GRC, and LaRC	Boeing, General Electric, Pratt & Whitney, Air Force Research Laboratory, FAA, Gulfstream, Goodrich, and Exa Corporation.

Acquisition Strategy

ISRP develops and further matures promising technologies to the integrated system-level. This necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

A full and open NRA is used as the means to solicit innovative proposals in key research areas that complement NASA expertise. One of the main objectives of the NRA investment is to stimulate close collaboration among NASA researchers and NRA award recipients to ensure effective knowledge transfer. ISRP awards grants, contracts, and cooperative agreements, primarily with industry, academia and non-profit institutions. These awards help strengthen the research capabilities that are of interest to NASA within the recipient organizations and institutions. The program also utilizes partnerships with cost sharing and in-kind contributions to gain access to system-level research and integration opportunities.

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Integrated Systems Research

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Relevance	Subject Matter Experts	08/2010	The National Research Council held a meeting of experts to review NASA's UAS integration in the NAS research. The meeting brought together experts in government, industry, and academia. Findings included strong community support for NASA's new UAS project and a recommendation to have strong coordination with other government agencies and industry to ensure safety of the NAS and proper integration of UAS into NextGen. NASA has considered the comments and observations the refined the plans accordingly.	N/A
Relevance	Expert Review	10/2010	A formulation review was held for the UAS integration in the NAS project. This review was an independent peer review and experts from other government agencies gave a recommendation to the ARMD AA on whether or not the technical plans address relevant challenges and can achieve the stated objectives and schedule within the allocated resources. The independent review panel recommended that the project proceed to implementation and the AA concurred.	N/A
Performance	Review Panel	10/2010	The 12-month review is a formal independent peer review. Experts from other government agencies report on their assessment of technical and programmatic risk and/or program weaknesses. In the FY 2010 review, the independent review panel rated ISRP and the ERA project overall as "excellent" on relevance and quality and "very good" on performance in their first year of execution.	11/2011

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	Aeronautics Strategy and Management

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**22.6**	**-**	**24.3**	**24.0**	**23.4**	**22.8**	**22.1**
Aeronautics Strategy and Management	22.6	-	24.3	24.0	23.4	22.8	22.1

Note:
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Program Overview

The ASM Program will be formed in FY 2012 to provide a more efficient management structure for the directorate. This new program's content and budget is from the transfer of the cross program activities from FAP and innovative concepts for aviation activities from ISRP. Therefore, no additional funding or change in content to the directorate results from this transfer.

ASM conducts research and provides programmatic support that does not fit well into the current five programs. ASM will be managed by headquarters and is organized into three main areas: Innovative Concepts for Aviation (ICA), Cross Program Support, and Education and Outreach. ICA supports early stage high risk research and technology demonstrations.

The cross program support area includes coordination and institutional expenses such as information technology, studies, and other administrative functions. Education and outreach activities support NASA's educational goals and communicate the results from Mission Directorate research.

Plans For FY 2012

ICA research is scheduled to begin in FY 2011. In FY 2012, the best ideas and concepts from the first year of research into new concepts and processes for aviation will be evaluated and considered for further study or incorporation into the existing research programs. Also in FY 2012, ICA technology demonstrations will be conducted.

Project Descriptions and Explanation of Changes

Aeronautics Strategy and Management

Aeronautics Strategy and Management is organized into three functional areas described below.

Innovative Concepts for Aviation explores novel concepts and new processes with the potential to create new capabilities in aeronautics research. ICA's goal is to mature the new concepts and incorporate them into the existing research programs or launch new avenues of aeronautics research. To meet this goal, both internal and external aeronautics communities will be targeted through solicitations, challenges, and prizes.

Cross Program Support funds institutional expenses such as information technology, studies, and other administrative functions. Also, coordination with JPDO is covered by cross program support funding.

Education and Outreach targets key constituencies in different age brackets and its activities are well integrated into the overall NASA portfolios, including providing subject matter experts and aeronautics-related materials that are complementary to the Agency portfolio. Students and teachers at all levels of learning are engaged through research grants, scholarship programs, internships, design competitions, exhibits and hands-on activities. Outreach through various media forums informs the general public and technical communities of the outcomes of ARMD research and supports the transition of knowledge to the aeronautics community.

Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
Not applicable	Not applicable	Not applicable

Program Management

The ARMD Associate Administrator has oversight responsibility for the program.

Acquisition Strategy

The research conducted through ICA activities will use a wide array of acquisition tools relevant to the research objectives including external solicitations through full and open competitions.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Other	Not applicable	N/A	Not applicable	N/A

Mission Directorate:	Aeronautics Research
Theme:	Aeronautics
Program:	ARMD Civil Service Labor and Expenses

FY 2012 Budget Request

Budget Authority ($ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	**0.0**	**-**	**196.7**	**201.7**	**210.6**	**220.7**	**231.3**
ARMD Civil Service Labor and Expenses	0.0	-	196.7	201.7	210.6	220.7	231.3

Program Overview

This program contains labor funding, both salary and benefits, for civil service employees at NASA's Centers who are assigned to work on projects in ARMD. These funds support the critical skills and capabilities required to provide the technology development, as outlined in the other programs, within this mission area.